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THE ANALYSIS OF THE RELATIONSHIP BETWEEN CO₂ LEVEL AND ECONOMIC GROWTH

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Abstract

2019 was Earth's second warmest year since 1850. In 2019 the global mean temperature was cooler than in 2016, but warmer than any other year explicitly measured. Consequently, 2016 is still the warmest year in historical observation history. Year-to-year rankings are likely to reflect natural fluctuations in the short term, but the overall pattern remains consistent with a long-term global warming trend. This would be predicted from global warming caused by greenhouse gases, temperature increase across the globe is broadly spread, impacting almost all areas of land and oceans. Climate change" and "global warming" are often used interchangeably but are of distinct significance. Global warming is the long-term heating of the Earth's climate system observed since the pre-industrial period as a result of human activities, mainly the combustion of fossil fuel, which raises the heat-trapping greenhouse gas levels in the Earth's air. The term is often used interchangeably with the term climate change, as the latter applies to warming caused both humanly and naturally, and the impact it has on our planet. This is most generally calculated as the average increase in global surface temperature on Earth. Carbon dioxide emission is one of the main reasons for global warming. Since the Industrial Revolution, human sources of carbon dioxide emissions have been growing. Human activities such as the burning of oil, coal and gas, as well as deforestation are the primary cause of the increased carbon dioxide concentrations in the atmosphere. In our research, let's examine the relationship between the amount of carbon dioxide emissions and the GDP/capita in developed and developing countries.

Keywords: global warming, CO₂, environment, protection, GDP, measures, trend, growth, developing and developed countries.

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1. Introduction

Climate change is one of the major international environmental challenges facing nations [1] and has the potential to cause catastrophic damages worldwide [2]. Scientific and economic consensus points to the need for a credible and cost-effective approach to address the threat of global climate change [3].

The ground and sea on the earth's surface would absorb the short-wave radiation from the sun and transform it into heat which, in the form of long-wave radiation, returns to the outer space. This circulation tends to regulate temperature on the planet. CO₂, CH₄ and other

greenhouse gasses, however, are involved in reflecting long-wave radiation from the atmosphere, creating the “greenhouse effect” as the earth surface temperatures increase [4].

The greenhouse effect is a natural occurrence due to the accelerated industrial growth of recent years triggered by the emission of significant quantities of greenhouse gases. Under this case, the air and sea temperatures will eventually rise and the glacial crust will melt in the Polar Regions, causing the rise in sea levels and the change of climate patterns [5–7].

The current warming trend is of special significance as much of it is highly likely to be the result of human activity since the mid-20th century and to continue at a pace unparalleled over decades to millennia [8].

General history of the issue of climate change [9–11] typically starts with Arrhenius or earlier scientific studies. But it was not until the mid-1970s that a larger group of experts, including policymakers started to concentrate on how, when, and how to reduce warming.

According to various empirical studies [12–14] economic growth affects the total amount of carbon emissions, but in turn, the amount of carbon emissions reflects the degree of economic development, there is a mutual two-way causal relationship between the two factors.

The aim of research is to examine the relationship between the amount of carbon emissions and the GDP/capita in developed and developing countries.

2. Methods

Data from countries were used ranked by GDP from the CIA database, as the database is also used to distinguish between developed and developing countries. The 2017 data were the baseline data listed in **Table 1**.

Table 1

Developed countries Source: CIA database, 2017 [15]

GDP-PPP rank	Country	GDP-PPP in USD (2017 est.)
1	China	25,360,000,000,000 USD
2	United States	19,490,000,000,000 USD
3	India	9,474,000,000,000 USD
4	Japan	5,443,000,000,000 USD
5	Germany	4,199,000,000,000 USD
6	Russia	4,016,000,000,000 USD
7	Indonesia	3,250,000,000,000 USD
8	Brazil	3,248,000,000,000 USD
9	United Kingdom	2,925,000,000,000 USD
10	France	2,856,000,000,000 USD

The ranking of the least developed countries has been more difficult to establish because it includes several countries that have recently been recognized or have unreliable data. Thus, in the research, 80–90 rankings from the CIA database are selected in **Table 2**.

Table 2

Developing countries Source: CIA database, 2017 Results [12]

GDP-PPP Rank	Country	GDP-PPP in USD (2017 est.)
1	2	3
80	Ghana	134,000,000,000 USD
81	Puerto Rico	130,000,000,000 USD
82	Serbia	105,700,000,000 USD
83	Panama	104,100,000,000 USD

Continuation of Table 2

1	2	3
84	Turkmenistan	103,700,000,000 USD
85	Croatia	102,100,000,000 USD
86	Cote d'Ivoire	97,160,000,000 USD
87	Lithuania	91,470,000,000 USD
88	Cameroon	89,540,000,000 USD
89	Uganda	89,190,000,000 USD
90	Jordan	89,000,000,000 USD

Let's plot the GDP values of the first 10 countries in **Fig. 1**.

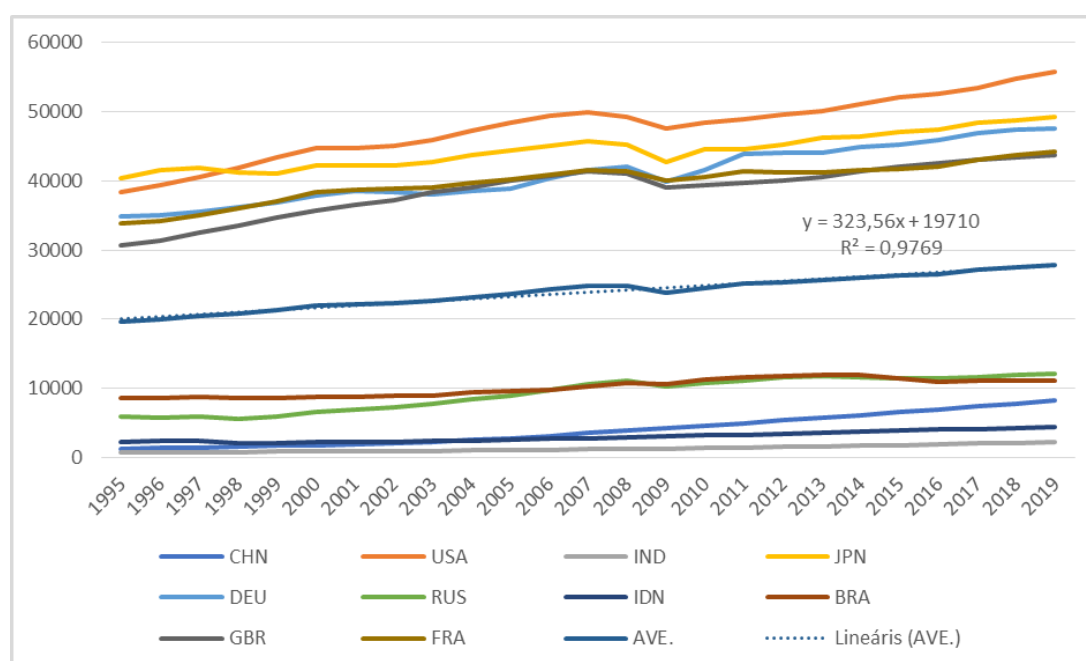


Fig. 1. GPD of the developed countries between 1995 and 2019

Source: authors' own editing based on WTI

3. Results

Continuing the study with developing countries, let's found in **Fig. 2** that Turkmenistan is the only country which GPD has achieved a higher increase than other countries, but developing countries have a much more homogeneous characteristic than developed countries.

Let's first examine the CO₂ emissions of developed countries between 1995 and 2016 based on the WDI [16] data available. The diagram in **Fig. 3** shows a decreasing trend, which is also supported by the linear trend line, in the trend formula the value of y has a negative sign and r^2 does not reach a whole, $y = -0.0066x + 0.4065$, $R^2 = 0.9501$. In other words, the environmental burden on developing countries is steadily declining.

As far as developing countries are concerned, let's obtain a more distributed picture based on **Fig. 4**, but here too CO₂ emissions are declining, y is also negative and r^2 is lower than in developed countries, $y = -0.0071x + 0.4034$, $R^2 = 0.881$.

It is possible to observe that both high and low GDP countries show a declining trend in CO₂ emissions, despite the fact that global emissions continue to rise drastically. After examining the data based on GDP, let's turn to the hypothesis that developed and developing countries react differently to carbon emission regulation and that this will have a demonstrable effect on the extent of GPD.

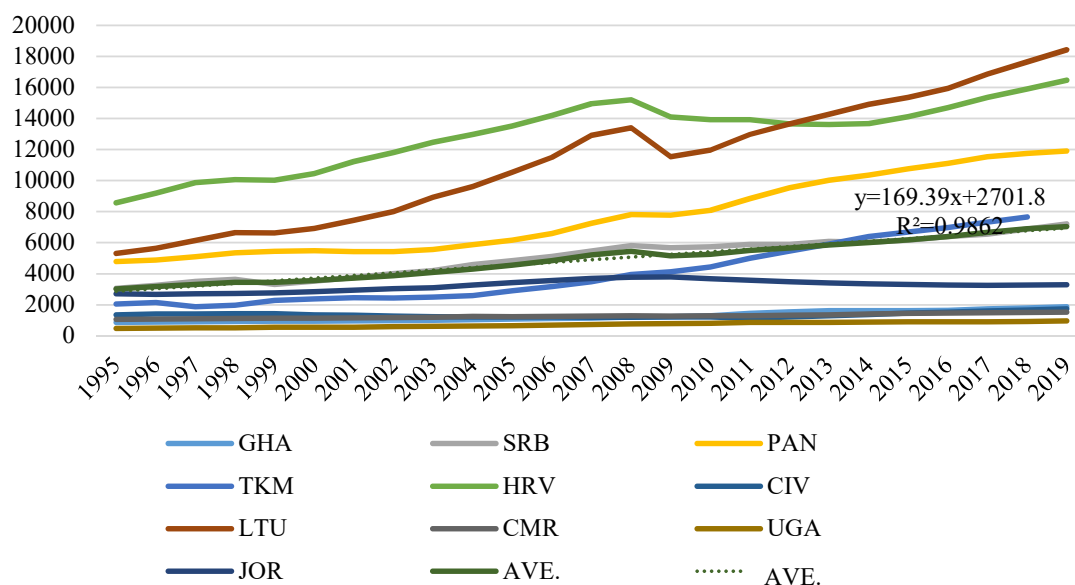


Fig. 2. GDP in developing countries between 1995 and 2019
Source: authors' own editing based on WTI

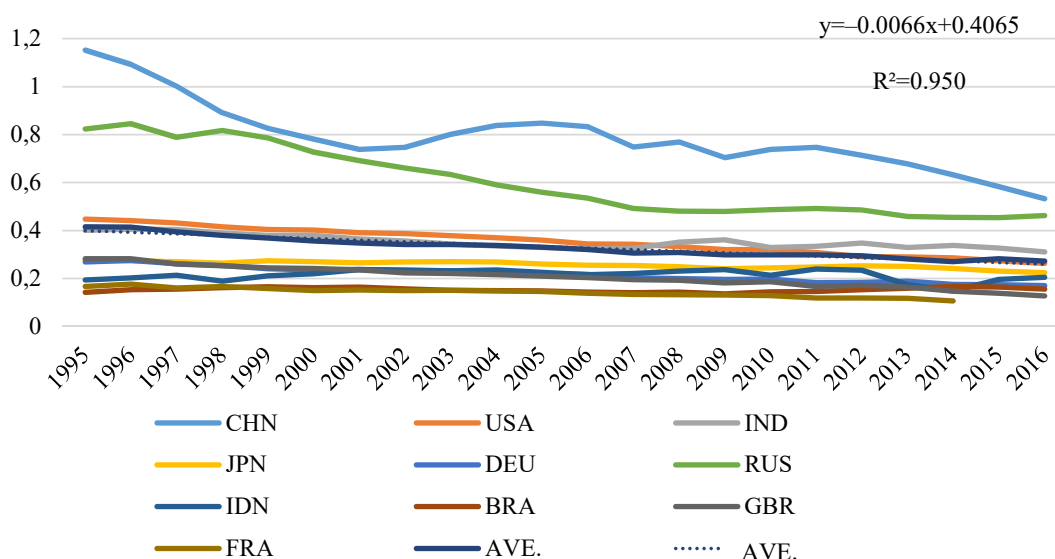


Fig. 3. CO₂ emissions of developed countries from 1995 to 2016
Source: authors' own editing based on WTI

In **Table 3**, let's examine the extent to which GDP and CO₂ averaged between each country with different levels of development in each year. It is possible to see that while GDP has been growing steadily in all of the two types of countries, in developed countries it stalled until 2009 and in developing countries it lasted until 2009 and 2010. In contrast, CO₂ emissions have been steadily declining, falling by 65 % in developed countries and 60 % in developing countries. Declining emissions were more even than in developed countries while in 2010 developing countries stalled.

As **Fig. 5** shows, the average GDP of developed countries is six times that of developing countries, which by 2016 fell to 4 times.

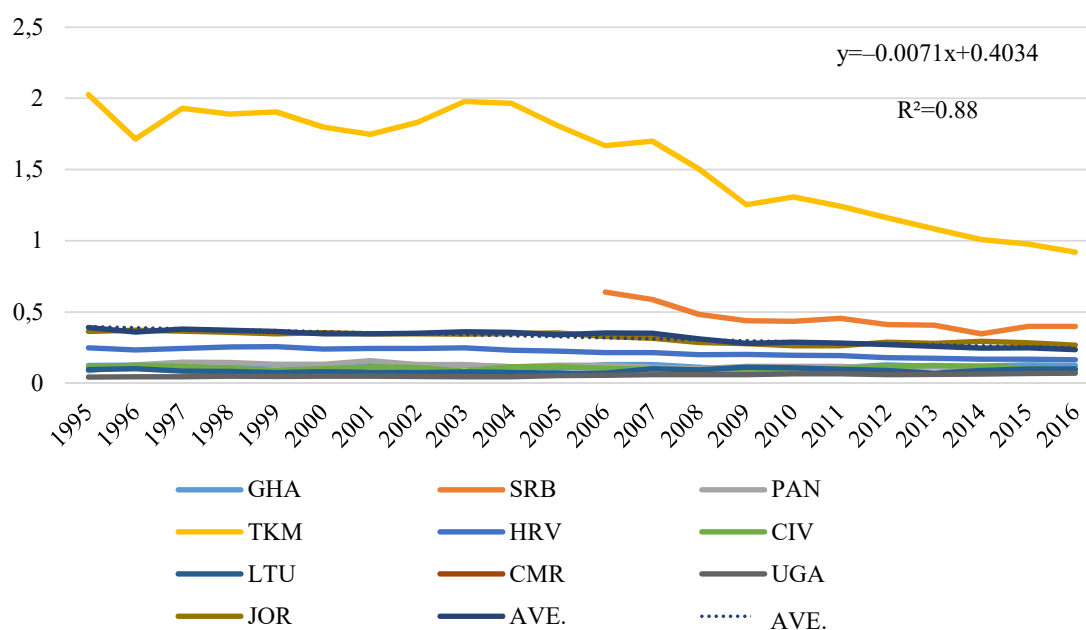


Fig. 4. CO₂ emissions in developing countries Source: authors' own editing based on WTI

Table 3

GDP and CO₂ emissions in developing and developed countries 1995–2016 Source: authors' own editing based on WTI

Years	Developed		Developing	
Year	AVEGDP	AVECO2	AVEGDP	AVECO2
1995	19670.72	0.416	3024.84	0.391
1996	20018.61	0.415	3166.85	0.359
1997	20460.71	0.395	3311.18	0.380
1998	20764.77	0.380	3442.65	0.372
1999	21212.75	0.369	3451.54	0.363
2000	21884.18	0.357	3562.32	0.347
2001	22145.63	0.348	3727.03	0.346
2002	22322.49	0.342	3877.41	0.350
2003	22633.84	0.341	4079.62	0.360
2004	23188.11	0.338	4306.46	0.357
2005	23662.71	0.331	4559.41	0.339
2006	24270.83	0.321	4841.66	0.352
2007	24845.48	0.305	5211.45	0.350
2008	24874.26	0.308	5443.06	0.311
2009	23841.84	0.298	5154.11	0.280
2010	24557.29	0.299	5244.23	0.287
2011	25083.00	0.298	5497.62	0.282
2012	25376.40	0.295	5664.59	0.271
2013	25700.92	0.281	5847.67	0.258
2014	26030.09	0.270	5999.01	0.246
2015	26321.40	0.282	6181.46	0.247
2016	26563.21	0.272	6396.25	0.236

Based on the chart, let's found that GDP growth in developed countries was lower than in developing countries despite the fact that CO₂ emissions changed at almost the same rate.

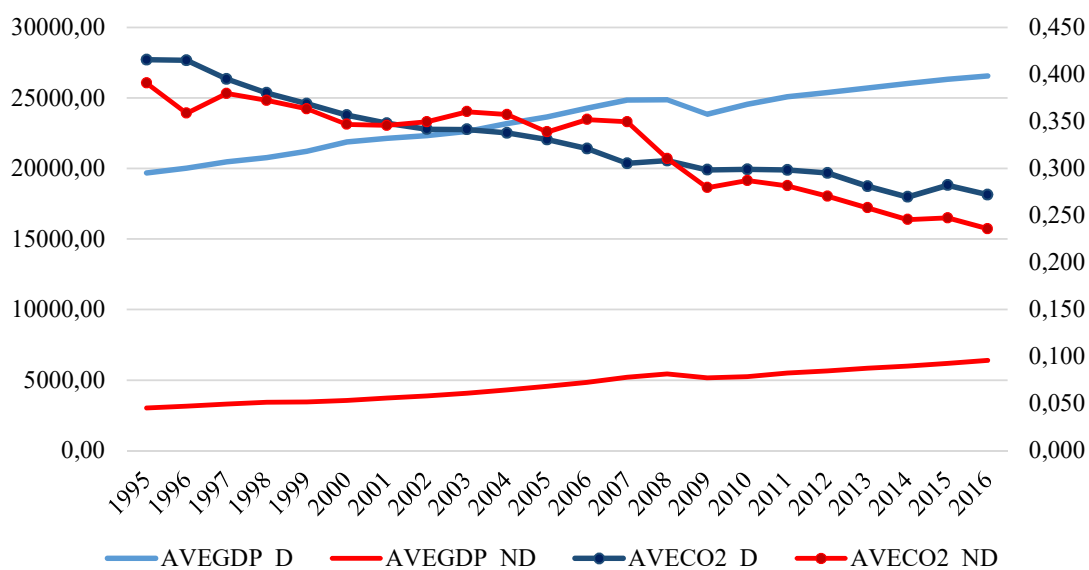


Fig. 5 GDP and CO₂ emissions between developed and developing countries
Source: authors' own editing based on WTI

4. Discussion

Economic growth is often pointed out to be the cause of environmental issues based on the notion that increased production equals increased pollution. However, some hypothesis that the relationship between economic growth and environmental degradation is more complex than that. Some even argue that economic growth could improve the environment. In a world where economies continue to develop and production constantly grows, it is important to understand the relationship between economic status and environmental degradation. The empirical result of several cross-sectional studies implies there is a relationship between GDP and carbon dioxide emissions. The correlation calculations usually positive, which suggests growing GDP, leads to increasing carbon dioxide emissions.

5. Conclusions

In our research, the relationships between the regulation of carbon emissions and the GDP/capita relationship between developed and developing countries are examined. It is possible to conclude that developed and developing countries show a non-linear negative relationship between GDP and CO₂ emissions, i.e., the higher their GDP, the lower their CO₂ levels will be. Developed nations typically have high carbon dioxide emissions per capita, while some developing countries lead in the growth rate of carbon dioxide emissions.

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